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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/792,127

03/04/2004

Wen Tong

7000-611

3909

27820 7590 02/24/2009  
WITHROW & TERRANOVA, P.L.L.C.  
100 REGENCY FOREST DRIVE  
SUITE 160  
CARY, NC 27518

EXAMINER

BURD, KEVIN MICHAEL

ART UNIT

PAPER NUMBER

2611

MAIL DATE

DELIVERY MODE

02/24/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<i>Office Action Summary</i>	Application No.	Applicant(s)	
	10/792,127	TONG ET AL.	
	Examiner	Art Unit	
	Kevin M. Burd	2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 18 December 2008.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 2-28,32-55 and 57-60 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 5 is/are allowed.
- 6) ☒ Claim(s) 2-4,6-8,10-13,15-28,32-43,48-55 and 57-60 is/are rejected.
- 7) ☒ Claim(s) 9,14 and 44-47 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)          | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

1. This office action, in response to the amendment filed 12/18/2008, is a non-final office action.

*Continued Examination Under 37 CFR 1.114*

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 12/18/2008 has been entered.

*Response to Arguments*

3. The previous rejection of the claims under 35 USC 112, first paragraph is withdrawn. The input means was specified in the advisory action mailed 11/3/2008.
4. Applicant's arguments filed 5/15/2008 regarding the rejection of the claims under 35 USC 102(e) have been fully considered but they are not persuasive.

Regarding the remarks with respect to claims 16, 17, 32, 35, 39, 50 and 52, applicant states Agrawal does not disclose receiving a subset of the weighted signals over a sub-group of the plurality of communication channels. The examiner disagrees. The claims do not recite what number of channels or number of weighted signals comprises a sub-group or subset respectively. The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication

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channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process. For these reasons, the rejections to the claims are maintained.

Regarding the remarks with regard to claim 3, Agrawal discloses the receive vector equals the effective channel response matrix times the input times the diagonal matrix in column 4, lines 49-62.

New claims 57-60 have been added. These newly added claims are addressed in the rejection stated below.

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 2-4, 6-8, 13, 15-20, 22, 26-28, 32, 34, 35, 38-43, 48-55 and 57-60 are rejected under 35 U.S.C. 102(e) as being anticipated by Agrawal et al (US 6,873,606).

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Regarding claims 13, 15, 16, 39-42 and 48, Agrawal discloses a method of processing signals to be transmitted on a plurality of communication channels (column 3, lines 17-28) using the system shown in figure 2. Each data stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream (abstract). The weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process.

Regarding claim 2, Agrawal discloses the channel response estimate and received SNR is received from the receiver (column 10, lines 4-17).

Regarding claims 3, 4, 6-8 and 43, Agrawal further discloses the method of figure 1. The data streams forms a diagonal matrix, selects a transmit basis matrix and scales each element with its associated weight. Off diagonal elements of the diagonal matrix will be forced to zero. Agrawal discloses the receive vector equals the effective channel response matrix times the input times the diagonal matrix in column 4, lines 49-62.

Regarding claim 49, Agrawal discloses a receiver in figure 2 for recovering the originally transmitted signal (column 9, lines 51-62).

Regarding claims 17, 19, 22, 26, 28, 49, 50 and 51, Agrawal discloses a method of processing signals to be transmitted on a plurality of communication channels (column 3, lines 17-28) using the system shown in figure 2. Each data stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream (abstract). The weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). Agrawal discloses a receiver in figure 2 for recovering the originally transmitted signal (column 9, lines 51-62). The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process.

Regarding claim 18, Agrawal discloses the channel response estimate and received SNR is received from the receiver (column 10, lines 4-17).

Regarding claims 20 and 27, Agrawal further discloses the method of figure 1. The data streams forms a diagonal matrix, selects a transmit basis matrix and scales each element with its associated weight. Off diagonal elements of the diagonal matrix will be forced to zero.

Regarding claims 32, 52, 54 and 55, Agrawal discloses a system for processing signals to be transmitted on a plurality of communication channels (column 3, lines 17-

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28 and figure 2). Each data stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream (abstract). The weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process.

Regarding claims 34 and 53, Agrawal discloses a receiver in figure 2 for recovering the originally transmitted signal (column 9, lines 51-62).

Regarding claims 35 and 38, Agrawal discloses a method of processing signals to be transmitted on a plurality of communication channels (column 3, lines 17-28) using the system shown in figure 2. Each data stream is scaled with a respective weight corresponding to the amount of transmit power allocated to that stream (abstract). The weights are based in the received channel response estimate and received SNR (column 10, lines 4-17). Agrawal discloses a receiver in figure 2 for recovering the originally transmitted signal (column 9, lines 51-62). The reference discloses receiving a subset of weighted channels over a sub-group of the plurality of communication channels in that the subset and sub-group is a number equal to or less than the total number of weighted signals and the total number of communication channels. The

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reference discloses coding the signals for transmission using the signal weights. A receiver will conduct the opposite (inverse) of the coding process to recover the original data. Therefore, the received signals are decoded using an inverse of the encoding process.

Regarding claims 57-60, Agrawal discloses the communication system shown in figure 2. The system discloses the transmitter comprises  $t$  antennas and the receiver comprises  $r$  antennas. Therefore, the total number of antennas can be greater than 4 for each of the transmitters and receivers. The sub-groups are equal to the number of transmit antennas and the receive antennas. This number will be greater than 2. The communication channels used will also be greater than 2.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 10-12, 23-25, 33, 36 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Agrawal et al (US 6,873,606) in view of Catreux et al (US 2005/0053170).

Regarding claims 10-12, 23, 25 and 37, Agrawal discloses the method and system stated above. Agrawal does not disclose an interference cancellation takes place. Catreux discloses the system and method for using the system shown in figure



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5A. Channel state information is used to weight signals in the MIMO system. Paragraph 0043 discloses one embodiment of the process for removing inter-symbol interference where the transmit signal is weighted with the inverse of the channel response at that frequency. Removing interference will allow the transmitted signal to be recovered correctly at the receiver. Other interference cancellation techniques are disclosed (paragraph 0010). It would have been obvious for one of ordinary skill in the art at the time of the invention to implement the interference cancellation techniques of Catreux in the method and system of Agrawal for the reason stated above.

Regarding claim 24, Catreux discloses using a MLSE equalizer and decoder at the receiver (figure 3).

Regarding claim 33, Agrawal discloses the method and system stated above. Agrawal does not disclose The MIMO system is a MIMO BLAST system. Catreux discloses V-BLAST MIMO systems realize very high data rates in rich scattering wireless channels (paragraph 0010), realizing very high data rates allow information to be transmitted and processed in less time than other systems. For this reason, it would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teaching of Catreux into the system of Agrawal.

Regarding claim 36, Agrawal discloses the method and system stated above. Agrawal does not disclose the processor system a ML decoder. Catreux discloses using a MLSE equalizer and decoder at the receiver (figure 3). The use of this decoder helps to offset the effects of frequency-selective fading as described in paragraphs 0039-0040. Fading causes errors in the transmitted signal. It would have been obvious for

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one of ordinary skill in the art at the time of the invention to combine the teachings of Catreux into the system of Agrawal to compensate for fading for the reason stated above.

7. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Agrawal et al (US 6,873,606) in view of Ottersten et al (US 5,828,658).

Regarding claim 21, Agrawal discloses the method and system stated above. Agrawal does not disclose the use of a Moore-Penrose pseudo-inverse matrix. Ottersten discloses the method and terminal shown in figure 1. A plurality of receiver antennas receives the incoming signal and provides information to the spatiotemporal processor as well as signal demultiplexors and demodulators. Optimization algorithms are used for calculating the transmit weights that minimize the transmission power according to the system (column 20, lines 49-56). The Moore-Penrose pseudo-inverse matrix is well known (column 23, lines 28-50) and is a component of the received channel response matrix. It would have been obvious for one of ordinary skill in the art at the time of the invention to use a well known matrix used in the calculation of the channel response in the channel response calculation disclosed by Agrawal. Utilizing well known calculation methods allows the method and system to operate at reduced cost since no new development need take place. In addition, accepted and well known methods have been proven to work successfully.

*Allowable Subject Matter*

8. Claim 5 is allowed.
9. Claims 14 and 44-47 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

*Conclusion*

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Buijore et al (EP 1 359 683 A1) discloses the MIMO communication system shown in figure 2. The signals are weighted and applied to specific sub-groups of the antenna arrays. The number of antennas in the sub-groups of the arrays is less than the total number of the antennas in the arrays. The method of communication between the transmitter and the receiver is described in the abstract. The abstract states the number of antennas in the transmitter sub group is preferably greater than or equal to two. Information regarding the weighting matrices is also provided.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M. Burd whose telephone number is (571) 272-3008. The examiner can normally be reached on Monday - Friday 9 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David C. Payne can be reached on (571) 272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kevin M. Burd/  
Primary Examiner, Art Unit 2611  
2/22/2009